

Application No.: 09/480,986

PATENT
Attorney Docket No.: 018035-001010US

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

See C

1. (Currently Amended) A method for operating a display having a plurality of pixel elements, comprises:

- a) applying a single transition voltage to the plurality of pixel elements via pixel electrodes on the display during a first period of time within a first field time, each pixel element including a liquid crystal material having at least a first state and a second state, wherein a transition of the liquid crystal material from the first state to the second state has an associated first transition time, wherein a transition of the liquid crystal material from the second state to the first state has an associated second transition time, wherein the first transition time is longer than the second transition time, and wherein the single transition voltage induces liquid crystal material in each pixel element to begin transitioning to the second state; thereafter
- b) while each pixel element is transitioning to the second state, applying a first paint voltage to one pixel element of the plurality of pixel elements during a second period of time within the first field time, wherein the first paint voltage induces liquid crystal material in the one pixel element to a third state; thereafter
- c) thereafter waiting a predetermined time period within the first field time;
- d) thereafter illuminating the one pixel element within the first field time;
- e) thereafter applying the single transition voltage to the plurality of pixel elements via the pixel electrodes on the display during a third first period of time within a second field time; thereafter
- f) thereafter applying a second paint voltage to the one pixel element elements during a fourth second period of time within the second field time, wherein the second paint voltage induces the liquid crystal material in the one pixel element to a fourth state; thereafter
- g) thereafter waiting the predetermined time period within the second field time; and thereafter
- h) thereafter illuminating the one pixel element within the second field time; wherein the single transition voltage is between the first paint voltage and the second paint voltage.

2. (Currently Amended) The method of claim 1 wherein d) comprises

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illuminating the one pixel element with an illumination source of a first color within the first field time, and h) comprises illuminating the one pixel element with an illumination source of a second color within the second field time.

3. (Currently Amended) The method of claim 1 further comprising
after h)

i) applying the single transition voltage to the plurality of pixel elements via the pixel electrodes on the display during a fifth first period of time within a third field time, wherein the transition voltage induces liquid crystal material in each pixel element to begin transitioning to the second state; thereafter

j) applying a third paint voltage to the one pixel element elements during a sixth second period of time within the third field time, wherein the third paint voltage induces the liquid crystal material in the one pixel element to a fifth state; thereafter

k) waiting the predetermined time period within the third field time; and thereafter

l) illuminating the one pixel element within the third field time, wherein d) comprises illuminating the one pixel element with an illumination source of a first color within the first field time, h) comprises illuminating the one pixel element with an illumination source of a second color within the second field time, and l) comprises illuminating the one pixel element with an illumination source of a third color within the third field time.

4. (Original) The method of claim 3 wherein the first color, the second color, and the third color are selected, without replacement, from the group: red color, green color, blue color.

5. (Previously Amended) The method of claim 1 wherein d) and h) both comprise illuminating the one pixel element with an illumination source.

6. (Previously Amended) The method of claim 1 wherein applying the single transition voltage to the plurality of pixel elements comprises applying the single transition voltage to all of the plurality of pixel elements at one time while holding a common electrode at a constant value.

7. (Currently Amended) The method of claim 1 wherein applying the single transition voltage to the plurality of pixel elements during the first period of time within the first field time comprises:

applying the single transition voltage to a first row of pixel elements from the plurality of pixel elements while holding a common electrode at a constant value; and thereafter

applying the single transition voltage to a second row of pixel elements from the plurality of pixel elements while holding the common electrode at a constant

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value.

8. (Currently Amended) The method of claim 1 wherein applying the single transition voltage to the plurality of pixel elements during the first period of time within the first field time comprises:

applying the single transition voltage to a first column of pixel elements from the plurality of pixel elements while holding a common electrode at a constant value; and thereafter

applying the single transition voltage to a second column of pixel elements from the plurality of pixel elements while holding the common electrode at a constant value.

9. (Currently Amended) A display having a plurality of pixel elements comprises:

a transaction circuit coupled to each pixel element in the plurality of pixel elements, the transaction circuit configured to apply a single first transition voltage to the plurality of pixel elements via pixel electrodes during a first time period within a first field time and a second transition voltage to the plurality of pixel elements via pixel electrodes during a second first time period within a second field time, each pixel element including a liquid crystal material having at least a first state and a second state, wherein a transition of the liquid crystal material from the first state to the second state has an associated first transition time, wherein a transition of the liquid crystal material from the second state to the first state has an associated second transition time, wherein the first transition time is longer than the second transition time, and wherein the single first transition voltage induces liquid crystal material in each pixel element to begin transitioning to the second state within the first field time, and wherein the second transition voltage induces the liquid crystal material in each pixel element to begin transitioning to the second state within the second field time;

a paint circuit coupled to the transaction circuit, the paint circuit configured to apply, while each pixel element is transitioning to the second state, a first paint voltage during a third second time period within the first field time and a second paint voltage during a fourth second time period within the second field time to one pixel element from the plurality of pixel elements after the single transition voltage is applied to the plurality of pixel elements, wherein the first paint voltage induces liquid crystal material in the one pixel element to a third state, and wherein the second paint voltage induces the liquid crystal material in the one pixel element to a fourth state;

a timer circuit coupled to the paint circuit, the timer circuit configured to determine when a predetermined time period has elapsed;

an illumination circuit coupled to the timer circuit, the illumination circuit configured to illuminate the one pixel element after the predetermined time period has elapsed within the first field time and within the second field time;

wherein the single first transition voltage is applied to the plurality of pixel

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elements during the first time period within the first field time before the first paint voltage is applied to the plurality of pixel elements during the third second time period within the first field time, and wherein the single second transition voltage is applied to the plurality of pixel elements during the second first time period within the second field time after the one pixel element is illuminated within the first field time and before the second paint voltage is applied to the plurality of pixel elements during the fourth second time period within the second field time.

10. (Currently Amended) The display of claim 9

wherein the illumination circuit is configured to illuminate the one pixel element with a first color within the first field time after the first paint voltage is applied to the one pixel element, and

wherein the illumination circuit is configured to illuminate the one pixel element with a second color within the second field time after the second paint voltage is applied to the pixel element.

11. (Currently Amended) The display of claim 9

wherein the paint circuit is also configured to apply a third paint voltage to one pixel element from the plurality of pixel elements during a fifth second time period within a third field time after the single first transition voltage is applied to the plurality of pixel elements during a first time period within the third field time, wherein the third paint voltage induces the liquid crystal material in the one pixel element to a fifth state;

wherein the single first transition voltage is applied to the plurality of pixel elements within the first time period with the third field time after the one pixel element is illuminated during the second field time and before the third paint voltage is applied to the plurality of pixel elements;

wherein the illumination circuit is configured to illuminate the one pixel element with a first color within the first field time after the first paint voltage is applied to the plurality of pixel elements;

wherein the illumination circuit is configured to illuminate the one pixel element with a second color within the second field time after the second paint voltage is applied to the plurality of pixel elements; and

wherein the illumination circuit is configured to illuminate the one pixel element with a third color within the third field time after the third paint voltage is applied to the plurality of pixel elements.

12. (Original) The display of claim 11 wherein the first color, the second color, and the third color are selected, without replacement, from the group: red color, green color, blue color.

13. (Original) The display of claim 9 wherein the illumination circuit comprises a monochromatic illumination source.

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14. (Currently Amended) The display of claim 9 wherein applying the single first transition voltage to the plurality of pixel elements during the first time period within the first field time comprises applying the single first transition voltage to all of the plurality of pixel elements at one time while holding a common electrode at a constant value; and

wherein the first transition voltage and the second transition voltage are between the first paint voltage and the second paint voltage.

15. (Currently Amended) The display of claim 9 wherein the transaction circuit is configured to apply the single first transition voltage to a first row of pixel elements from the plurality of pixel elements while holding a common electrode at a constant value before a second row of pixel elements from the plurality of pixel elements during the first time period.

16. (Currently Amended) The display of claim 9 wherein the transaction circuit is configured to apply the single first transition voltage to a first column of pixel elements from the plurality of pixel elements while holding a common electrode at a constant value before a second column of pixel elements from the plurality of pixel elements during the first time period.

17. (Currently Amended) A circuit for driving a liquid crystal display having a plurality of pixels comprises:

an initializing circuit coupled to the plurality of pixels configured to apply a single initial first voltage to the plurality of pixels via pixel electrodes during a first time period of a first field and configured to apply a second voltage to the plurality of pixels via the pixel electrodes during a second first time period within a second field, each pixel including a liquid crystal material having at least a first state and a second state, wherein a transition of the liquid crystal material from the first state to the second state has an associated first transition time, wherein a transition of the liquid crystal material from the second state to the first state has an associated second transition time, wherein the first transition time is longer than the second transition time, and wherein the single transition voltage induces liquid crystal material in each pixel to begin transitioning to the second state;

a driving circuit coupled to the initializing circuit configured to apply a first drive voltage during a third second time period within the first field, in which each pixel element is transitioning to the second state after the first time period within the first field, and a second drive voltage during a fourth second time period within the second field after the first time period within the second field to a pixel from the plurality of pixels after the initial voltage has been applied to the plurality of pixels, wherein the first drive voltage induces the liquid crystal material in the one pixel to a second third state, and wherein the second drive voltage induces the liquid crystal material in the one pixel to a third fourth state; and

an illumination circuit coupled to the driving circuit configured to

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illuminate the pixel for a predetermined time period within the first field and within the second field after the pixel has been driven with the first drive voltage and after the pixel has been driven with the second drive voltage, respectively;

wherein the single initial voltage is applied to the plurality of pixels during the first time period before the pixel is driven with the first drive voltage during the third time period, and

wherein the single initial voltage is applied to the plurality of pixels during the second time period before the second drive voltage is applied to the plurality of pixels during the fourth time period.

18. (Currently amended) The circuit of claim 17

wherein the illumination circuit is configured to illuminate the pixel with a first color within the first field after the first drive voltage has been applied to the pixel, and

wherein the illumination circuit is configured to illuminate the pixel with a second color within the second field after the second drive voltage has been applied to the pixel;

wherein the first transition voltage and the second transition voltage are substantially similar.

19. (Currently Amended) The circuit of claim 17 18 wherein the first color and the second color are selected, without replacement, from the group: red color, green color, blue color.

20. (Currently Amended) The circuit of claim 17 wherein the initializing circuit is configured to apply an initial first voltage to all of the pixels in the plurality of pixels at one time while holding a common electrode at a constant value.

21. (Currently Amended) The circuit of claim 17 wherein the initial first voltage is between the first drive voltage and the second drive voltage.

22. (Currently Amended) A method for operating a liquid crystal display having a plurality of pixel elements, the method comprising: comprises: applying a first single transition voltage to pixel electrodes of a the plurality of pixels pixel elements of the liquid crystal display to initiate a transition of liquid crystal material in the plurality of the pixels pixel elements to a clear bright state within a first color field; thereafter

while the plurality of pixel elements are transitioning to the bright state, applying a first drive voltage to a pixel electrode of at least one pixel element of the plurality of pixels pixel elements to initiate a transition of liquid crystal material in at least one pixel into a second state within the first color field; thereafter

waiting a predetermined time period; and thereafter

illuminating at least the one pixel within the first color field element.

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23. (Currently Amended) The method of claim 22 wherein applying the first single transition voltage to the plurality of pixel electrodes of the plurality of pixel elements pixels comprises applying the first single transition voltage to pixel electrodes all of the plurality of pixel elements pixels at one time.

24. (Currently Amended) The method of claim 22 wherein applying the first single transition voltage to the plurality of pixel electrodes of the plurality of pixel elements pixels comprises:

applying the first single transition voltage to pixel electrodes a first row of the pixel elements pixels while holding a common electrode at a constant value along a first row of pixels from the plurality of pixels; and thereafter

applying the first single transition voltage to pixel electrodes a second row of the pixel elements pixels while holding a common electrode at a constant value along a second row of pixels from the plurality of pixels

25. (Currently Amended) The method of claim 22 wherein applying the first single transition voltage to the plurality of pixel electrodes of the plurality of pixel elements pixels comprises:

applying the first single transition voltage to pixel electrodes a first column of the pixel elements pixels while holding a common electrode at a constant value along a first column of pixels from the plurality of pixels; and thereafter

applying the first single transition voltage to pixel electrodes a second column of the pixel elements pixels while holding a common electrode at a constant value along a second column of pixels from the plurality of pixels

26. (New) The method of claim 22 further comprising:

applying a second voltage to the pixel electrodes of the plurality of pixels of the liquid crystal display to initiate a transition of the liquid crystal material in the plurality of pixels to the clear state within a second field; thereafter

applying a second drive voltage to the pixel electrodes of at least one pixel of the plurality of pixels to initiate a transition of liquid crystal material in at least one pixel into a third state within the second color field; thereafter

illuminating at least the one pixel within the second color field.

27. (New) The method of claim 26 wherein the first voltage and the second voltage are selected from a range between the first drive voltage and the second drive voltage.

28. (New) The method of claim 26 wherein the first voltage and the second voltage are substantially similar.

29. (New) The method of claim 26 wherein the first color field and the second color field are within the same frame.

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30. (New) The method of claim 26 wherein the first color field and the second color field are selected without replacement from the group: red field, green field, blue field.